

WHAT IS CLAIMED IS:

- 1 1. A device for ablating tissue, comprising:
2 an ablating device having at least one ablating element and a bottom surface,
3 the bottom surface being positioned adjacent to tissue to be ablated; and
4 a cover extending over the bottom surface;
5 a cavity defined by a space between the cover and bottom surface; and
6 a flowable material positioned in the cavity;
7 wherein the cover is movable relative to the ablating device to a position
8 which exposes the bottom surface while leaving the flowable material positioned between the
9 ablating device and the tissue to be ablated.

- 1 2. The device of claim 1, wherein:
2 the ablating device has a removable tip.

- 1 3. The device of claim 1, wherein:
2 the flowable material has a boiling temperature of at least 100 degrees C and a
3 vapor pressure higher than water.

- 1 4. The device of claim 1, wherein:
2 the flowable material is selected from the group consisting of PEG and
3 glycerine.

- 1 5. The device of claim 1, wherein:
2 the ablating device has a plurality of ablating elements.

- 1 6. The device of claim 1, wherein:
2 the ablating device forms a closed loop.

- 1 7. The device of claim 1, wherein:
2 the cover is a sleeve which surrounds the ablating device.

- 1 8. A method of ablating tissue, comprising the steps of:
2 providing an ablating device and a cover, the ablating device having a bottom
3 surface, the cover being spaced apart from the bottom surface to define a fluid cavity, the
4 fluid cavity containing a fluid;

5 positioning the cover against a tissue surface;
6 moving the cover away from the bottom surface so that the bottom surface is
7 exposed and positioned adjacent the tissue surface, the flowable material conforming to the
8 shape of the tissue surface and being positioned between the bottom surface of the ablating
9 device and the tissue surface; and
10 ablating the tissue after the moving step.

1 9. The method of claim 8, wherein:
2 the positioning step is carried out with the tissue surface being an epicardial
3 surface.

1 10. The method of claim 8, wherein:
2 the moving step is carried out by moving the cover while substantially
3 maintaining the position of the ablating device.

1 11. The method of claim 8, wherein:
2 the providing step is carried out with the cover having a removable tip.

1 12. The method of claim 8, wherein:
2 the providing step is carried out with the flowable material having a boiling
3 temperature of at least 120 degrees C

1 13. The method of claim 8, wherein:
2 the providing step is carried out with the flowable material being selected from
3 the group consisting of PEG and glycerine.

1 14. The method of claim 8, wherein:
2 the providing step is carried out with the ablating device having a plurality of
3 ablating elements.

1 15. The method of claim 8, wherein:
2 the providing and moving steps are carried out with the ablating device
3 forming a closed loop.

1 16. The method of claim 15, wherein:

2 the providing and moving steps are carried out with the ablating device
3 forming a closed loop around the pulmonary veins; and
4 the ablating step is carried out to form an ablation around the pulmonary veins.

1 17. A device for ablating tissue, comprising:
2 a body having a first part and a second part which are coupled together to form
3 a closed loop and separated to open the closed loop;
4 at least one ablating element mounted to the body; and
5 a flexible tip extending from an end of the body, the tip extending for at least
6 two inches and being free of any ablating elements, the flexible tip facilitating advancement
7 of the body through a space between the epicardium and pericardium.

1 18. The device of claim 17, wherein:
2 the tip is removable from the body.

1 19. The device of claim 17, wherein:
2 the body has a plurality of ablating elements attached thereto.

1 20. The device of claim 17, wherein:
2 the ablating device has an ultrasonic transducer.

1 21. The device of claim 17, wherein:
2 the body has a convex bottom surface which is positioned adjacent the tissue
3 to be ablated.

1 22. The device of claim 21, wherein:
2 a membrane forms the convex surface.

1 23. The device of claim 22, wherein:
2 the membrane partially defines a cavity containing a fluid.

1 24. The device of claim 17, wherein:
2 the ablating device has a plurality of ablating elements.

1 25. The device of claim 17, wherein:
2 the ablating device forms a closed loop around the heart.

1 26. A system of forming an ablation from an epicardial location,
2 comprising the steps of:
3 a liquid delivery device for delivering a liquid to a space between the
4 pericardium and epicardium to create a liquid environment around the heart; and
5 at least one ablating element for ablating tissue when submerged in the liquid
6 environment around the heart.

1 27. The system of claim 26, wherein:
2 the ablating element is an element selected from the group consisting of RF,
3 ultrasound, microwave, cryo and laser

1 28. The system of claim 26, wherein:
2 the liquid delivery device is delivered through a penetration in the
3 pericardium.

1 29. A method of ablating tissue from an epicardial location, comprising the
2 steps of:
3 providing an ablating device having a tip;
4 advancing the ablating device through a space between the epicardium and
5 pericardium;
6 removing the tip of the ablating device; and
7 ablating tissue with the ablating device.

1 30. The method of claim 29, further comprising the step of:
2 forming a closed loop with the ablating device after the removing step.

1 31. The method of claim 29, wherein:
2 the advancing step is carried out with the ablating device having a plurality of
3 ablating elements.

1 32. The method of claim 29, wherein:
2 ablating step is carried out to form an ablation around the pulmonary veins.

1 33. The method of claim 29, wherein:

2 the providing step is carried out with the tip having a length of at least two
3 inches and being free of ablating elements.

1 34. The method of claim 33, wherein:
2 the providing step is carried out with the tip having a length of at least four
3 inches.

1 35. A method of forming an ablation from an epicardial location,
2 comprising the steps of:
3 creating a liquid environment around a patient's heart;
4 positioning an ablating device against an epicardial location of the patient's
5 heart; and
6 ablation tissue from the epicardial location while the ablating device is
7 contained within the liquid environment.

1 36. The method of claim 35, wherein:
2 the creating step is carried out by at least partially filling the pericardial space
3 with the liquid to create the liquid environment around the patient's heart.

1 37. The method of claim 35, wherein:
2 the ablating step is carried out with the ablating device being submerged
3 within the liquid.

1 38. The method of claim 35, wherein:
2 the creating step is carried out with the liquid environment being contained by
3 the pericardium.

1 39. The method of claim 35, wherein:
2 the ablating step is carried out with the ablating device having an ablating
3 element which uses RF, ultrasound, laser, cold or microwave.

1 40. The method of claim 35, wherein:
2 the creating step is carried out with the pericardium being incised to create an
3 opening, the fluid environment having an exposed free surface of the liquid.

1 41. The method of claim 35, wherein:

2 the creating step is carried out with the ablating device passing through a
3 penetration in the pericardium.

1 42. A method of ablating tissue, comprising the steps of:
2 providing an ablating device having a convex contact surface;
3 positioning the convex contact surface adjacent to an epicardial surface;
4 ablating the epicardial tissue after the positioning step.

1 43. The method of claim 42, wherein:
2 the providing step is carried out with the ablating device comprising an
3 ultrasonic transducer.

1 44. The method of claim 43, wherein:
2 the providing step is carried out with the convex surface being formed by an
3 element mounted to the ultrasonic transducer.

1 45. The method of claim 44, wherein:
2 the providing step is carried out with a membrane forming the convex surface.

1 46. The method of claim 45, wherein:
2 the providing step is carried out with the membrane partially defining a cavity
3 containing a fluid.

1 47. The method of claim 42, wherein:
2 the providing step is carried out with the ablating device having a plurality of
3 ablating elements.

1 48. The method of claim 42, wherein:
2 the providing and moving steps are carried out with the ablating device
3 forming a closed loop around the heart.

1 49. The method of claim 48, wherein:
2 the providing and moving steps are carried out with the ablating device
3 forming a closed loop around the pulmonary veins; and
4 the ablating step is carried out to form an ablation around the pulmonary veins.

1 50. An ablating device for ablating tissue, comprising:

2 a body;
3 an ablating element coupled to the body;
4 a membrane extending over at least part of the ablating element, the membrane
5 being spaced apart from the ablating element to form a fluid cavity; and
6 the fluid cavity containing a fluid.

1 51. The ablating device of claim 50, further comprising:
2 a fluid source coupled to the fluid inlet for circulating the fluid through the
3 fluid cavity.

1 52. The ablating device of claim 51, further comprising:
2 a heat exchanger having an inlet which receives the fluid and an outlet which
3 returns the fluid to the fluid cavity.

1 53. The ablating device of claim 50, wherein:
2 the membrane forms a convex contact surface.

1 54. The ablating device of claim 50, wherein:
2 the membrane forms the convex contact surface with fluid pressure.

1 55. The ablating device of claim 50, wherein:
2 the membrane permits some of the fluid to pass therethrough to wet the target
3 tissue with the fluid.

1 56. The ablating device of claim 50, wherein:
2 the membrane extends over more than one ablating element.

1 57. An ablating device for ablating tissue, comprising:
2 a body;
3 an ablating element coupled to the body;
4 a flexible skirt surrounding at least a portion of the ablating element;
5 the fluid cavity containing a fluid.

1 58. The ablating device of claim 57, further comprising:
2 a fluid delivery channel which delivers fluid to the fluid cavity.

1 59. The ablating device of claim 57, wherein:

2 the body has a contact surface on a bottom side, the contact surface being
3 convex.

1 60. A method of ablating tissue from an epicardial location using a device
2 according to claims 51-59.

RECORDED IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

